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Short communication

Suicide by crashing into a heavy vehicle: A one-year follow-up study of professional drivers

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ABSTRACT

Train and heavy vehicle drivers can experience a traumatic event caused by people attempting suicide by crashing into their vehicles or jumping in front of them. While there are a number of studies on train drivers showing the negative consequences these events can have on their well-being, there are no studies on heavy vehicle drivers involved in these types of crashes. In the current study, we surveyed Finnish heavy vehicle drivers (N = 15) involved in a suicide crash in the year 2017 regarding their experiences and coping approximately one month (T1) and one year (T2) after the crash. Ten of these drivers reported one or various combinations of measurable consequences such as minor physical injuries, shorter or longer sickness absences, significant posttraumatic stress symptoms (measured using the Impact of Events Scale-Revised) and requiring psychological help. Posttraumatic stress symptoms decreased over time; however, three out of the four drivers who had a high IES-R score at T1 were still around the IES-R cut-off score at T2. This research raises questions whether and what kind of support heavy vehicle drivers who have been involved in a suicide crash should be given.

1. Introduction

Some suicides are attempted while in traffic. A person who jumps under a moving train or a heavy vehicle or deliberately steers their vehicle towards a heavy vehicle will directly and instantly have an impact on the drivers of these vehicles who are very likely unknown to them. In this brief report, we present a one-year follow-up study of Finnish heavy vehicle drivers involved in a suicide crash. Studies on this specific population are lacking and, therefore, we briefly introduce studies conducted on train drivers acknowledging that the extent and duration of the impact as well as the probability of experiencing such an event may differ between these two professions.

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An important difference between train and truck drivers in relation to such deliberate crashes is in the objective, and probably also the perceived, amount of control in preventing them. The only available options for train drivers are alerting (e.g., loud horn sound) people who are standing on or close to railway tracks and braking. However, stopping a train requires more time and distance than stopping even the largest truck. Therefore, by the laws of physics, truck drivers can potentially slow down their vehicle faster, thereby reducing the force of the impact. Furthermore, truck drivers can swerve their vehicle in order to prevent a crash. However, such maneuvers can have negative consequences for the driver such as rolling their vehicle or colliding with a hard stationary object.

Heavy vehicle drivers also have an increased likelihood of injury in the case of a suicide collision than train drivers. In our previous study (Radun, Parkkari, et al., 2019), we found that almost 30% of 138 truck drivers were injured in collisions caused by a suicidal driver crashing a car into their vehicle. However, only a few suffered serious injuries.

The third difference between train and truck drivers is the degree of probability of experiencing such an event in the first place. As we discussed previously (Radun, Radun, et al., 2019), given that truck drivers constitute a much larger group than train drivers, the individual and group risk of a crash is naturally lower for them. A review of the literature indicated that at least 2% of road crashes might be the result of deliberate self-destruction (Pompili et al., 2012). However, this is probably an underestimation because of difficulties in identifying such cases. In-depth crash data collected by Finnish multidisciplinary investigation teams show that about 11% of crashes involving a fatality in a motor vehicle were caused by a suicidal driver (Radun, Parkkari, et al., 2019). Although suicides by jumping or lying in front of a moving train has long been recognized as an occupational hazard for train drivers worldwide, only recently has it been shown that heavy vehicle drivers also "perceive road suicides as an occupational risk in their profession" in Finland (Radun, Radun, et al., 2019).

Train and truck drivers likely differ regarding the support they receive after being involved in a suicide crash. Train drivers are employed by a relatively small group of companies that typically have standardized procedures for how to deal with so-called "person under the train" (PUT) incidents. For example, according to Airaksinen, Korpinen and Parkkari (2016), train drivers for the Finnish railway company VR have clear instructions about how to behave in a crash situation and afterwards, the instructions (both printed and on tablet computer) are always with them while driving; their shift ends either immediately or at the first possible opportunity, every driver visits an occupational health nurse or doctor at least once where the need for further treatment is evaluated, and drivers decide themselves when they are ready to return to work. As far as we are aware, even the largest truck companies do not have similar procedures in place. This is understandable given the already mentioned differences in expected risk between train and truck drivers, their numbers as well as the number of companies employing them.

Finally, truck and train drivers differ with regards to the attention they have received in the suicide collision research literature. As has been recently pointed out, studies about road suicides typically "only mention the proportion of heavy vehicles as the other party in suicide crashes and whether the drivers were seriously injured" (Radun, Parkkari, et al., 2019). On the other hand, there are a number of studies focusing on train drivers and their experiences following PUT incidents. For example, Swedish subway drivers who experienced a PUT incident reported a "successively worsened psychosocial work situation during the 12 months of follow-up" (Theorell, Leymann, Jodko, Konarski, & Norbeck, 1994). In a cross-sectional study, Norwegian train drivers who had experienced "on-the-track accidents" reported more current health problems than accident-free drivers (Vatshelle and Moen, 1997). In this study, posttraumatic stress symptoms (measured using the original Impact of Event Scale; Horowitz, Wilner, & Alverez, 1979) were positively related to health problems. French train drivers who had experienced a PUT incident exhibited immediate psychological disturbances; however, these disappeared within a year (Cothereau et al., 2004). A similar reduction of distress symptoms one year following a railway accident was found among Norwegian train drivers (Karlehagen et al., 1993). In Northern Germany, 44% of the drivers involved in PUT incidents and who participated in a rehabilitation program suffered from moderate to severe PTSD (Mehnert, Nanninga, Fauth, & Schafer, 2012). In this study, anxiety, a sense of guilt and a sense of alienation were the best predictors of posttraumatic stress six months after rehabilitation (Mehnert et al., 2012). In general, there is wide variation in the prevalence of posttraumatic symptoms, the symptoms tend to decrease with time, and successful rehabilitation seems to depend on the quality of support the drivers receive.

Although there are no studies focusing specifically on the experiences of truck drivers following a suicide by crashing into their vehicle, it is well known that those involved in road crashes can suffer chronic psychological dysfunction, which includes depressive, anxious and phobic symptoms, as well as reduced social contact, pleasure from leisure activities and work capacity (Taylor, 2011). Posttraumatic stress disorder is common in road crashes especially following a fatality (Heron-Delaney, Kenardy, Charlton, & Matsuoka, 2013).

This comparison between train and truck drivers is provided to show that the findings obtained from the population of train drivers cannot easily translate to the population of truck drivers. This difficulty does provide motivation for filling the identified gap in the research literature. In this study, we surveyed, on two occasions, heavy vehicle drivers involved in a suicide crash regarding their experiences and coping after the crash.

2. Methods

The recruitment of drivers was done in cooperation with the Finnish Crash Data Institute (Finnish: Onnettomuustietoinstituutti-OTI). OTI is responsible for the in-depth investigation of all fatal road crashes in Finland. Their

work is regulated by a special law act on the investigation of road and cross-country traffic crashes and financed by the state. OTI's multidisciplinary teams consist of a police officer, a vehicle engineer, a traffic engineer, a physician, and a psychologist or behavioral scientist (Radun et al., 2019). Potential participants were approached by a police officer at the scene immediately following the crash or by telephone during the normal investigation process. The participants provided the police officer with their postal or email address to which we later sent a consent form and a survey. Several participants signed the consent form during their discussion with the police officer, while others provided consent by post or email along with a completed survey.

2.1. The survey

The first survey was sent about one month after the crash (T1) and the follow-up survey one year after the crash (T2). The surveys were almost identical in order to enable direct comparison. They included questions about background factors (age, sex, weight, height, and driving exposure), consequences of the crash (injuries, sickness absence and psychotherapy), drivers' views about their crash and several scales. The scales included the Impact of Events Scale–Revised (IES-R; Weiss & Marmar, 1997), the Crisis Support Scale (CSS; Joseph, Andrews, Williams, & Yule, 1992), the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), the Generalized Anxiety Disorder 7-item scale (GAD; Spitzer, Kroenke, Williams, & Lowe, 2006) and the Karolinska Sleep Questionnaire (KSQ; Åkerstedt et al., 2002; Nordin, Åkerstedt, & Nordin, 2013).

The Impact of Events Scale-Revised (IES-R) measures the degree of subjective distress (i.e., posttraumatic stress symptoms) during the past seven days in relation to a traumatic event (Weiss & Marmar, 1997). This widely used scale has 22 items rated on a scale from (0)"not at all" to (4) "extremely" and a cut-off score of 33.

The Crisis Support Scale (CSS; Joseph et al., 1992) is a seven-item scale for measuring received social support with items on a seven-point scale ((1)"never" to (7)"always"). We somewhat modified the questions in this scale so that the respondents had to answer whether they were satisfied with the current support at T1 while at T2 we asked them whether they were satisfied with the support they had received since the crash. This means that answers obtained at T1 and T2 are not fully comparable. The CSS score was averaged (i.e., total score divided by the number of items– 7) rather than compiling a total score only because the scale does not have a cut-off score.

The Generalized Anxiety Disorder 7-item scale (GAD; Spitzer et al., 2006) measures whether respondents suffer from general anxiety and worry too much about everyday life events on a four-point scale of (0) "not at all" to (3)"nearly every day" (15). A total score of 0–4 is considered a minimal level of anxiety severity, 5–9 as mild, 10–14 as moderate and 15–21 as severe (Spitzer et al., 2006).

The Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) measures the perception of stress, has 10 items rated on a five-point scale ranging from (0) "never" to (4)"very often". The total score ranges from 0 to 40.

The Karolinska Sleep Questionnaire (KSQ) measures sleep disturbances (Åkerstedt et al., 2002; Nordin, Åkerstedt, & Nordin, 2013). It has 18 items describing different sleep problems participants might have experienced during the preceding three months. Two items ("Gasping for breath during sleep" and "Cessation of breathing during sleep") were not included in our survey because they refer to sleep apnea disorder and it is unlikely that the drivers would develop it after the suicide event. We also had to modify the time frame (we reduced to it to one month) and accordingly modify the answers (see the supplementary materials) as we surveyed participants one month after the crash. Our KSQ results are not fully comparable with previous research. We calculated the "disturbed sleep index" (DSI; 4 items), the "non-refreshing sleep" (NRS; 3 items), and the fatigue/sleepiness index (6 items). The fatigue index was calculated only for answers at T2 because its items include a distinction between work and free time and this was not relevant for many of the participants as they were not fully working during the first month after the crash.

2.2. Participants

The inclusion criteria were Finnish heavy vehicle drivers (trucks or buses) who had a pedestrian throw themselves in front of their vehicle and drivers of motor vehicles deliberately crashing into their vehicle. Since the exact cause of the crash may not be known before the investigation has been concluded, the OTI police officers were instructed to also recruit heavy vehicle drivers who were considered a second participant in the crash. This was done to make sure no suicide cases were missed in the early stage of the investigation. After the investigation was complete, the selected cases and returned surveys were classified as either suicide or other types of crashes.

The initial plan was to cover crashes that happened during the year 2017 and although there were some attempts to extend it to 2018, the process of recruitment was finally terminated in April 2018. Nevertheless, we included the responses from a driver who was involved in a suicide crash in February 2018. Based on the OTI computerized database, there were 26 suicides involving a heavy vehicle as a second party in 2017. Of these, seven included a pedestrian throwing themselves in front of a heavy vehicle and 19 drivers crashing a motor vehicle into a heavy vehicle. In one car-to-truck crash, the heavy vehicle driver was from Russia and was not invited to participate. Out of 25 potential participants, 18 gave us their permission to send them more information about the study including the consent form and the survey. In addition to these drivers, an invitation was also sent to a heavy vehicle driver involved in a suicide crash attempt in which the suicidal driver was so badly injured that it was predicted they would die; however, the driver survived. Together with one case from 2018, we, therefore, sent an invitation to 20 drivers, out of which 14 responded to both surveys, one responded only to the first survey

only and five did not respond at all. All fifteen respondents were male with a mean age of 42 (SD = 11.8). Two thirds had a lifetime mileage as a professional driver above 1 mil. kilometers; three (younger) drivers between 300,000 – 500,000 km and two between 500,000 and 1 mil. kilometers. The participants were primarily truck drivers with one bus driver.

As described earlier, we also sent invitations to participate in the study to heavy vehicle drivers who were second participants in non-suicide crashes. We sent invitations to 14 drivers, out of which eight responded to both surveys, three responded only to the first one and three did not respond at all. These cases are discussed in our report published in Finnish (Radun, Radun, Kaistinen, & Parkkari, 2019).

2.3. Statistical analysis

Participants responded to survey questions at an initial time point (median: 38 days post-crash, min: 31, max: 141) and at a follow-up time (median: 378 days post-crash, min: 363, max: 467). A linear mixed model approach was used to estimate the change in dependent variables over time with random intercepts for each participant. This approach utilizes the exact days post-crash instead of categorized pre/post time points, and it accounts for inter-subject dependence. Post-hoc comparisons were then made using the estimated model at 30- and 365-days post-crash.

We did not statistically compare suicide vs. other crashes for two reasons. First, other crashes are obviously less homogeneous than suicide crashes in terms of the behavior of the other road user who caused the crash, complicating any attempt to draw conclusions. Secondly, we did not have enough statistical power for such independent sample comparison due to the small number of cases (only eight non-suicide cases). Therefore, as already mentioned, these other cases were briefly discussed in our report to be published in Finnish. We report also correlations between CSS, GAD, IES-R and PSS.

The study protocol was approved by the University of Helsinki's Ethical Review Board in Humanities and Social and Behavioral Sciences (statement 36/2016).

3. Results

Two-thirds of the drivers reported in the survey they had been taken to hospital for an examination immediately after their crash. Four reported minor injuries and 11 were uninjured at T1; however, one driver reported crash-related serious physical health problems at T2, which he also mentioned as the reason he stopped working as a professional driver. Seven drivers reported taking sick leave at T1. The durations were short for five drivers (4, 5, 7, 8, and 14 days), while two were still on sick leave, one for more than 1.5 months and the other for more than four months.

When asked at T1 whether they thought they would continue working as a professional heavy vehicle driver, 13 drivers answered definitely yes, one probably yes, and one probably no. At T2, two out of 14 no longer worked as a driver, but the reason for one was unrelated to his crash, while the other one was the already mentioned driver with serious health problems.

Information about where to seek psychological help was offered to 13 out of 15 drivers. Four drivers reported seeking psychological help at T1 and one additional driver reported doing so at T2. All five reported that receiving help was beneficial. At T2 only one driver reported not receiving help from their employer when he needed it (two of the drivers were self-employed, while the other 11 received help or said they did not need it).

None of the drivers blamed themselves for the crash, at T1 or T2. Almost all (14/15) drivers felt that they could have done nothing to prevent the crash. Three drivers mentioned that the road conditions made it difficult to avoid the collision. When asked at T2 whether they followed news reports about their crash, nine said they read reports if they randomly saw them, three actively looked for the news, one avoided reading any reports, and one did not answer this question.

Table 2 summarizes the effect of time on posttraumatic stress symptoms (IES-R), perceived stress (PSS), anxiety (GAD), perceived social support (CSS) and sleep disturbances (KSQ). Only two drivers had a higher IES-R score at T2 than at T1 (Fig. 1); however, both of them reported other life events that, according to them, had affected their well-being. Furthermore, scores on both occasions were low and in one case very similar (7->16 and 2->4). The third driver who had a significant life event unrelated to the crash had a similar IES score on both occasions (16 and 14). Figures for CSS, GAD, and PSS as well as the correlation matrix are reported in supplementary materials.

4. Discussion

To the best of our knowledge, this is the first study to focus on how professional heavy vehicle drivers cope after being involved in a crash caused by a suicidal driver or pedestrian. In our small sample of 15 drivers, 10 experienced some kind of measurable consequences (Table 1). One of them stopped working as a professional heavy vehicle driver due to a crash-related injury. Another person went on long-term sick leave, had posttraumatic stress symptoms (as indicated by a high IES-R score) and sought psychological help. The other eight drivers had various combinations of minor physical injuries, shorter or longer sickness absences, significant posttraumatic stress symptoms and a need for psychological help.

Not surprisingly, posttraumatic stress symptoms positively correlated with anxiety (GAD) and perceived stress (PSS). However, on a group level, GAD scores were low (Table 2) with only two drivers having severe anxiety at T1 and one at T2 (Figure S2). Similarly, low average scores were observed for PSS (Table 2) with only one driver having a score above

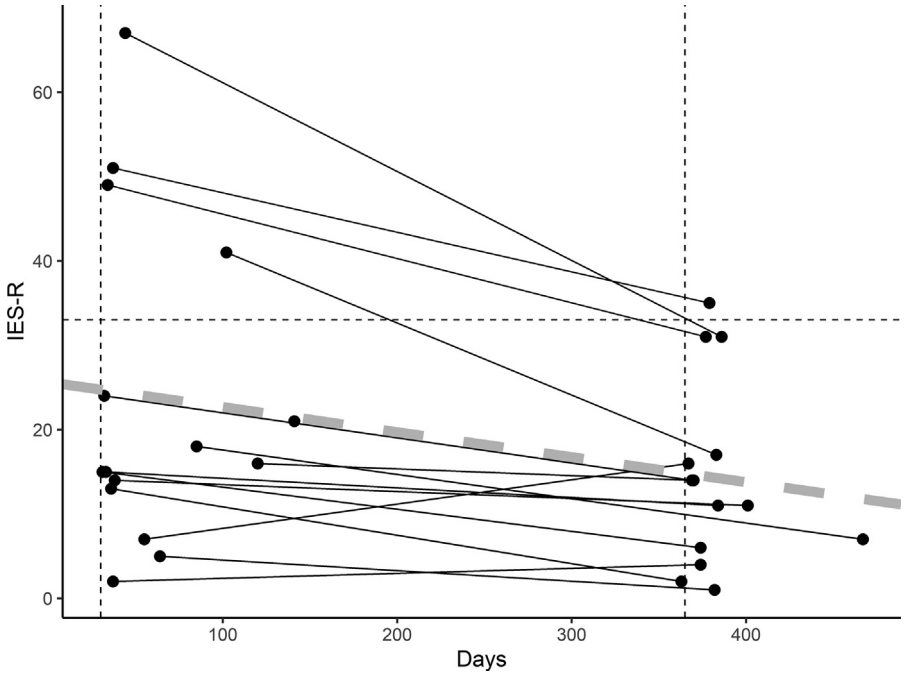

Fig. 1. Posttraumatic stress symptoms measured using the Impact of Events Scale-Revised. The horizontal dashed line represents the cut-off score of 33. The two vertical lines represent 30 and 365 days since the crash. The grey dashed line represents the fitted regression line.

Table 1
Crash consequences for the drivers.

N	Injury	Sickness absence (short: up to 2 weeks or long: more than a month)	High IES-R score at T1	Sought psychological help
1	+	S	+	–
1	–	L	+	+
1	+	L	–	–
1	+	S	–	+
1	+	S	–	–
1	–	S	–	+
1	–	S	+	–
1	–	–	+	–
2	–	–	–	+
5*	–	–	–	–

* One of these drivers only completed the first survey.

Table 2
Comparison between scale scores obtained approximately one month and one year after the crash.

	Mean (95% CI)		Mean difference (95% CI), p-value
	30 days	365 days	
IES-R	24.74 (15.87, 33.62)	14.81 (6.18, 23.44)	−9.93 (−16.45, −3.41), p = 0.006
GAD-7	3.78 (1.05, 6.52)	2.60 (−0.11, 5.31)	−1.18 (−2.43, 0.07), p = 0.062
PSS	9.98 (6.24, 13.73)	9.46 (5.83, 13.10)	−0.52 (−3.39, 2.35), p = 0.700
CSS	5.94 (5.50, 6.38)	5.73 (5.31, 6.15)	n.a.
KSQ-DSI	1.03 (0.40, 1.66)	0.97 (0.37, 1.58)	−0.06 (−0.55, 0.43), p = 0.804
KSQ-NRS	1.03 (0.42, 1.64)	1.10 (0.50, 1.70)	0.07 (−0.25, 0.40), p = 0.631
KSQ-fatigue	n.a.	0.30 (−0.01, 0.62)	n.a.

20 at T1 and two drivers at T2 (Figure S3). These lower scores are not surprising because GAD and PSS measure more general and stable traits while IES-R is designed to measure the direct consequences of a traumatic event. Sleep disturbance indices from KSQ were also low on a group level with only a few individuals having somewhat higher scores. Taken together, these results are consistent with previous studies on the impact of traumatic events (including those from a population of train drivers) showing that not all individuals suffer serious consequences after experiencing a traumatic event.

Most of the drivers were satisfied with the level of social support they received (Figure S4). On a scale of 1–7, the estimated average score was 5.94 at approximately 30 days after the crash and 5.73 for the whole period since the crash to one year after the crash. The support was negatively correlated with IES-R, GAD and PSS. Lack of social support is important predictor of posttraumatic stress symptoms (Heron-Delaney et al., 2013; Ozer et al., 2003); however, our design does not allow for interpretation about causality as it is also possible that those experiencing high posttraumatic stress symptoms were unhappy with the support they had received.

Five drivers who received psychological help found it useful. Four of them explicitly wrote that talking helped. This is not surprising, but raises questions whether it is enough that professional drivers involved in a fatal crash only receive information about how to seek help. A routine occupational health assessment for all of them probably cannot be organized at a company level due to the limited resources of many small companies; however, professional associations and unions could potentially provide such help. Two Finnish professional drivers' associations already support a telephone helpline service for drivers. Members of OTI investigation teams as well as medical professionals routinely inform professional drivers involved in crashes about this helpline. However, drivers are not always motivated to seek help. Only one out of the four drivers with high IES-R scores at T1 actually received psychological help. Although there are a number of reasons why individuals in need of psychological help might not seek it, the continuing stigma around seeking treatment is a major factor (Corrigan, 2004). Both public (i.e., labeling and discriminating against people) and self-stigma (i.e., harm to self-esteem) may be a common barrier to seeking psychological help among heavy vehicle drivers due, in part, to a possible "macho culture" in this predominantly male profession (Skogstad, Skorstad, Lie, Conradi, & Weisaeth, 2013). Making visits to occupational health specialists obligatory might be a solution to this problem.

Not surprisingly, posttraumatic stress symptoms decreased over time; however, three out of the four drivers who had high IES-R scores one month after the crash were around the IES-R cut-off score one year after the crash. We are unaware of studies examining whether road crash survivors with significant PTSD symptoms are at high(er) risk of another crash; however, studies from the populations of war veterans suggest the link between PTSD and higher mortality from motor vehicle crashes (Boehmer, Flanders, McGeehin, Boyle, & Barrett, 2004; Drescher, Rosen, Burling, & Foy, 2003; Knapik, Marin, Grier, & Jones, 2009). Given that professional drivers drive heavy vehicles every day, cover tens of thousands of kilometers every year, offering them psychological support when needed would be justified from a traffic safety perspective as well.

4.1. Limitations

The main limitation of this study is the small number of participants. This number was determined by the annual number of road suicides rather than a poor response rate. We do not know the exact response rate as we do not know how many potentially eligible participants refused to respond to our survey or how many potential participants failed to be informed about the survey. Importantly, 14 out of 15 drivers who responded at T1 also responded at T2. Seven drivers explicitly wrote positively about the survey or stressed the need for this kind of study. Furthermore, we had no baseline data nor control group. Finally, our models assumed a linear relationship between time and our outcome variables. This may not be true in general due to possible floor or ceiling effects for bounded outcome measures such as GAD, and caution should be exercised when extrapolating beyond the observed time frame.

5. Conclusion

The results of our study show that professional heavy vehicle drivers who experience a deliberate crash into their vehicle often suffer from both physical injuries and posttraumatic stress symptoms. Although it is clear that not all drivers will develop such symptoms, we believe all of them should routinely be sent to an occupational health specialist post-collision to evaluate the need for psychological treatment. These drivers have experienced the death of another person in a violent crash at work and should receive similar help as that given to train drivers after person under the train incidents. Whether that is feasible and how such help could be organized are yet to be seen.

CRediT authorship contribution statement

Igor Radun: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Writing - review & editing, Funding acquisition. **Jenni Radun:** Conceptualization, Methodology, Investigation, Writing - review & editing. **Jyrki Kaistinen:** Conceptualization, Methodology, Writing - review & editing. **Inkeri Parkkari:** Writing - review & editing. **Göran Kecklund:** Conceptualization, Methodology, Writing - review & editing. **Jake Olivier:** Conceptualization, Methodology, Formal analysis, Visualization, Writing - review & editing. **Töres Theorell:** Conceptualization, Methodology, Writing - review & editing.

Declaration of Competing Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trf.2020.07.003.

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